8. CYLINDER HEAD/VALVE/CAMSHAFT

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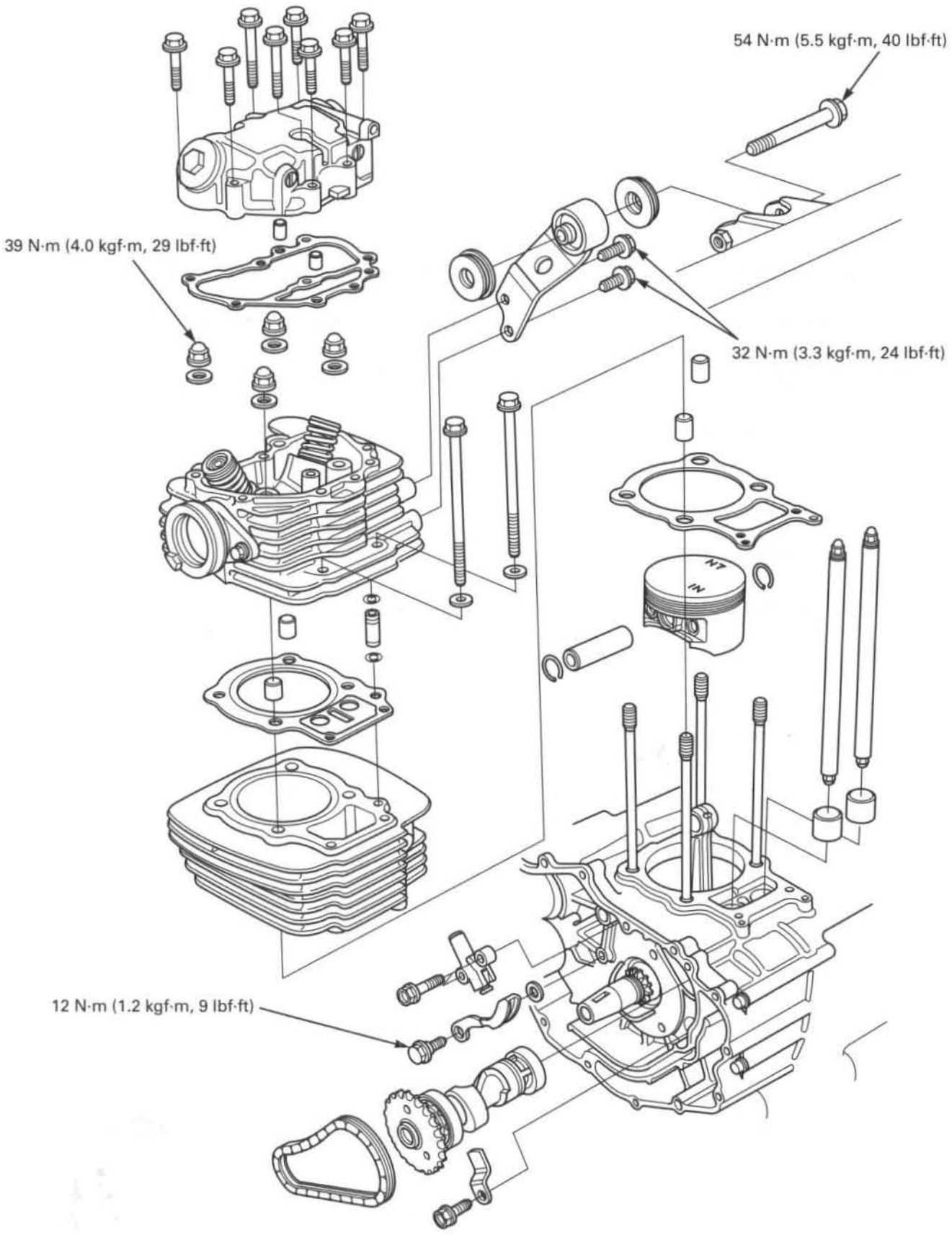
SYSTEM COMPONENTS



SERVICE INFORMATION

GENERAL

- This section covers service of the rocker arms, cylinder head, valves and camshaft. These services can be done with the engine installed in the frame.
- When disassembling, mark and store the disassembled parts to ensure that they are reinstalled in their original locations.
- Clean all disassembled parts with cleaning solvent and dry them by blowing them off with compressed air before inspection.
- Rocker arm, valve and camshaft lubricating oil is fed through oil passages in the cylinder head and head cover. Clean the oil passages before assembling cylinder head and head cover.
- Be careful not to damage the mating surfaces when removing the cylinder head cover and cylinder head.

SPECIFICATIONS

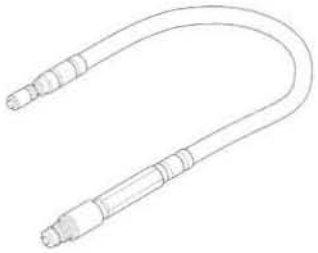
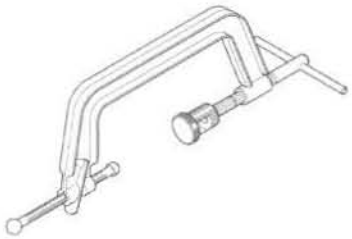
Unit: mm (in)

ITEM			STANDARD	SERVICE LIMIT
Cylinder compression at 450 rpm			736 kPa (7.5 kgf/cm², 107 psi)	–
Valve clearance		IN	0.15 (0.006)	–
		EX	0.15 (0.006)	–
Valve, valve guide	Valve stem O.D.	IN	5.475 – 5.490 (0.2156 – 0.2161)	5.45 (0.215)
		EX	5.455 – 5.470 (0.2148 – 0.2154)	5.43 (0.214)
	Valve guide I.D.	IN/EX	5.500 – 5.512 (0.2165 – 0.2170)	5.53 (0.218)
	Stem-to-guide clearance	IN	0.010 – 0.037 (0.0004 – 0.0015)	0.12 (0.005)
		EX	0.030 – 0.057 (0.0012 – 0.0022)	0.14 (0.006)
	Valve guide projection above cylinder head	IN	15.8 – 16.0 (0.62 – 0.63)	–
		EX	15.8 – 16.0 (0.62 – 0.63)	–
	Valve seat width	IN/EX	1.0 – 1.1 (0.039 – 0.043)	1.4 (0.06)
Valve spring	Free length	Inner	37.8 (1.49)	37.04 (1.458)
		Outer	42.7 (1.68)	41.85 (1.648)
Rocker arm	Arm I.D.	IN/EX	12.000 – 12.018 (0.4724 – 0.4731)	12.05 (0.474)
	Shaft O.D.	IN/EX	11.964 – 11.984 (0.4710 – 0.4718)	11.92 (0.469)
	Arm-to-shaft clearance	IN/EX	0.016 – 0.054 (0.0006 – 0.0021)	0.08 (0.003)
Camshaft and cam follower	Cam lobe height	IN	35.9795 – 36.2195 (1.41651 – 1.42600)	35.84 (1.411)
		EX	35.9245 – 36.1654 (1.41435 – 1.42383)	35.79 (1.409)
	Cam follower O.D.	IN/EX	22.467 – 22.482 (0.8845 – 0.8851)	22.46 (0.884)
	Follower bore I.D.	IN/EX	22.510 – 22.526 (0.8862 – 0.8868)	22.54 (0.887)
	Follower-to-bore clearance	IN/EX	0.028 – 0.059 (0.0011 – 0.0023)	0.07 (0.003)
Cylinder head warpage			–	0.10 (0.004)

TORQUE VALUES

Cylinder head flange cap nut	39 N·m (4.0 kgf·m, 29 lbf·ft)	Apply oil to the threads and seating surface
Cam chain tensioner pivot bolt	12 N·m (1.2 kgf·m, 9 lbf·ft)	Apply a locking agent to the threads
Timing hole cap	10 N·m (1.0 kgf·m, 7 lbf·ft)	
Exhaust pipe stud bolt	See page 1-15	
Engine hanger bracket bolt (frame side)	54 N·m (5.5 kgf·m, 40 lbf·ft)	
Engine hanger bracket bolt (engine side)	32 N·m (3.3 kgf·m, 24 lbf·ft)	

TOOLS

Compression gauge attachment 07510-MB00101  or equivalent commercially available in U.S.A.	Valve spring compressor 07757-0010000 	Valve guide remover, 5.5 mm 07742-0010100
Valve guide reamer, 5.510 mm 07984-2000001 or 07984-200000D (U.S.A. only)	Cutter holder, 5.5 mm 07781-0010101 or equivalent commercially available in U.S.A.	Flat cutter, 35 mm (IN 32°) 07780-0012300 or equivalent commercially available in U.S.A.
Flat cutter, 30 mm (EX 32°) 07780-0012200 or equivalent commercially available in U.S.A.	Seat cutter, 35 mm (IN 45°) 07780-0010400 or equivalent commercially available in U.S.A.	Seat cutter, 29 mm (EX 45°) 07780-0010300 or equivalent commercially available in U.S.A.
Interior cutter, 37.5 mm (IN 60°) 07780-0014100 or equivalent commercially available in U.S.A.	Interior cutter, 30 mm (EX 60°) 07780-0014000 or equivalent commercially available in U.S.A.	

TROUBLESHOOTING

- Engine top-end problems usually affect engine performance. These can be diagnosed by a compression test, or by tracing top-end noise with a sounding rod or stethoscope.
- If the performance is poor at low speeds, check for a white smoke in the crankcase breather hose. If the hose is smoky, check for seized piston ring (page 9-2).

Compression too low, hard starting or poor performance at low speed

- Valves:
  - Incorrect valve adjustment
  - Burned or bent valve
  - Incorrect valve timing
  - Broken valve spring
  - Uneven valve seating
  - Valve stuck open
- Cylinder head:
  - Leaking or damaged cylinder head gasket
  - Loose spark plug
  - Warped or cracked cylinder head
- Cylinder/piston problem (page 9-3)

Compression too high, overheating or knocking

- Excessive carbon build-up on piston head or combustion chamber
- Worn or damaged decompressor system

Excessive smoke

- Worn valve stem or valve guide
- Damaged stem seal
- Cylinder/piston problem (page 9-3)

Excessive noise

- Incorrect valve clearance
- Sticking valve or broken valve spring
- Excessively worn valve seat
- Worn or damaged camshaft
- Worn rocker arm and/or shaft
- Worn rocker arm follower or valve stem end
- Worn or damaged push rod and/or cam follower
- Worn cam chain
- Worn or damaged cam chain tensioner
- Worn cam sprocket teeth
- Cylinder/piston problem (page 9-3)

Rough idle

- Low cylinder compression

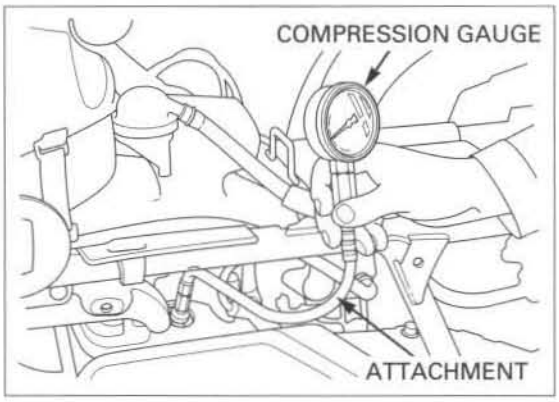
CYLINDER COMPRESSION

Warm up the engine to normal operating temperature.
Stop the engine, disconnect the spark plug cap and remove the spark plug (page 4-8).

Install the compression gauge into the spark plug hole.

TOOL:

Compression gauge attachment **07510-MB00101 or equivalent commercially available in U.S.A.**



Shift the transmission in neutral.
Open the throttle all the way and crank the engine with the starter motor until the gauge reading stops rising. The maximum reading is usually reached within 4 – 7 seconds.

COMPRESSION PRESSURE:
736 kPa (7.5 kgf/cm², 107 psi) at 450 rpm

Check that there is no leakage at the gauge connection.

Low compression can be caused by:
- blown cylinder head gasket
- improper valve adjustment
- valve leakage
- worn piston ring or cylinder

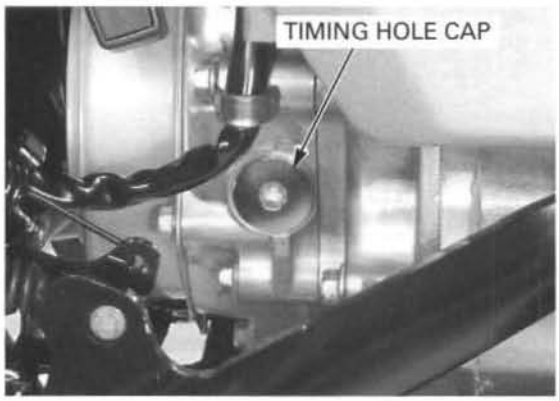
High compression can be caused by:
- carbon deposits in combustion chamber or on piston head

CYLINDER HEAD COVER REMOVAL/ DISASSEMBLY

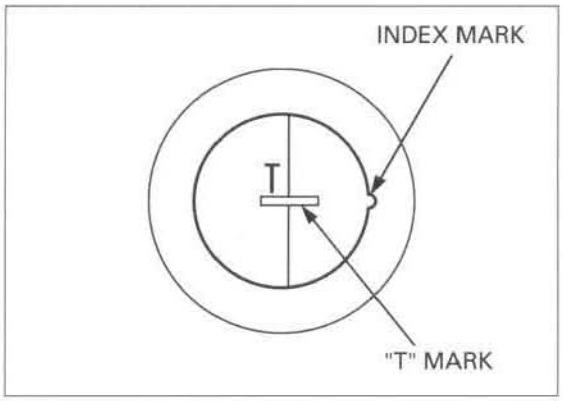
REMOVAL

Remove the fuel tank and heat guard plate (page 6-25).

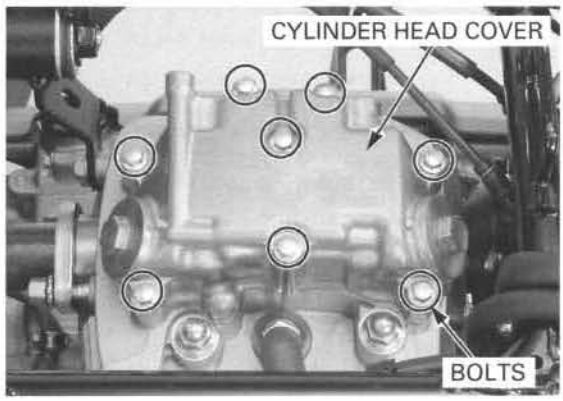
Remove the timing hole cap.



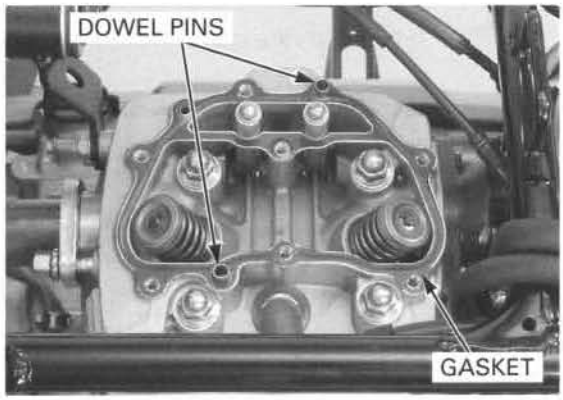
Turn the crankshaft with the recoil starter and align the "T" mark on the flywheel with the index mark on the rear crankcase cover.



Remove the bolts and cylinder head cover.



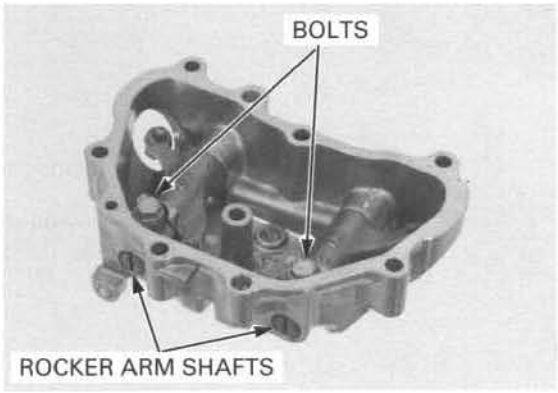
Remove the dowel pins and gasket.



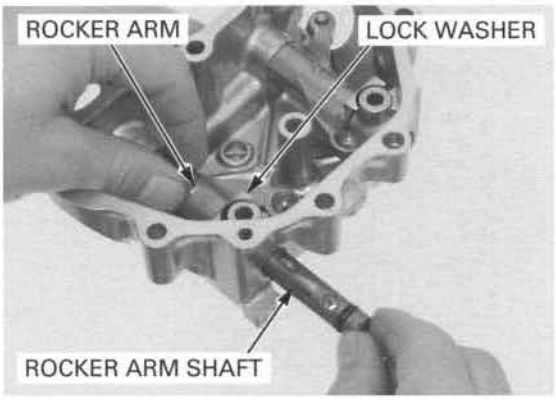
DISASSEMBLY

Remove the rocker arm shaft retaining bolts.

Push the rocker arm shaft with the small screwdriver through the bolt hole until the O-ring on the shaft is removed out of the head cover.



Remove the rocker arm shafts, lock washers and rocker arms.



INSPECTION

ROCKER ARM/SHAFT

Check the rocker arms and shafts for wear or damage.
If the rocker arm follower is worn or damaged, check the push rod and oil passages.
Measure each rocker arm shaft O.D.

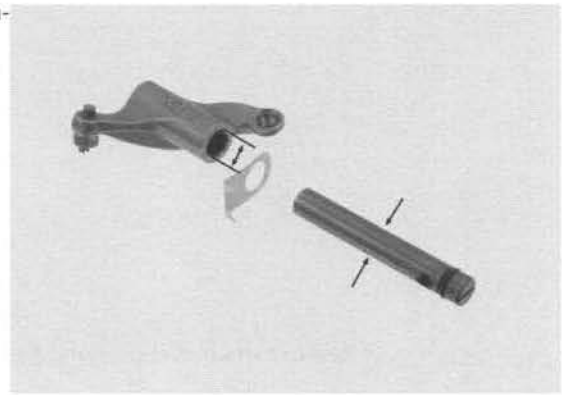
SERVICE LIMIT: 11.92 mm (0.469 in)

Measure each rocker arm I.D.

SERVICE LIMIT: 12.05 mm (0.474 in)

Subtract each rocker arm shaft O.D. from the corresponding rocker arm I.D. to obtain the rocker arm-to-shaft clearance.

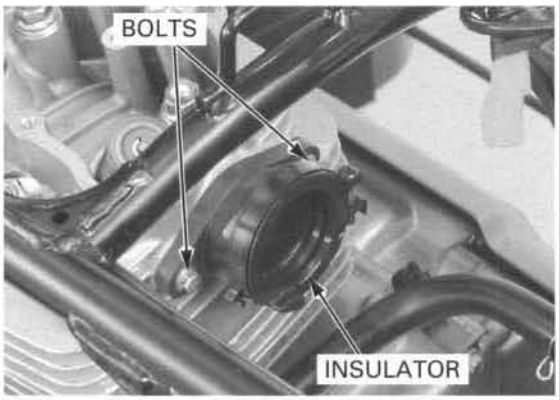
SERVICE LIMIT: 0.08 mm (0.003 in)



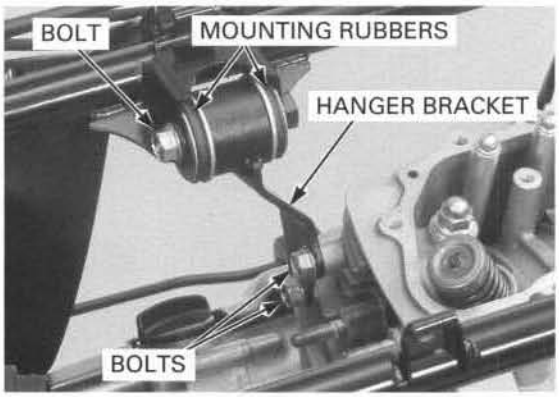
CYLINDER HEAD REMOVAL

Remove the following:
- carburetor (page 6-7)
- exhaust pipe (page 3-14)
- cylinder head cover (page 8-6)

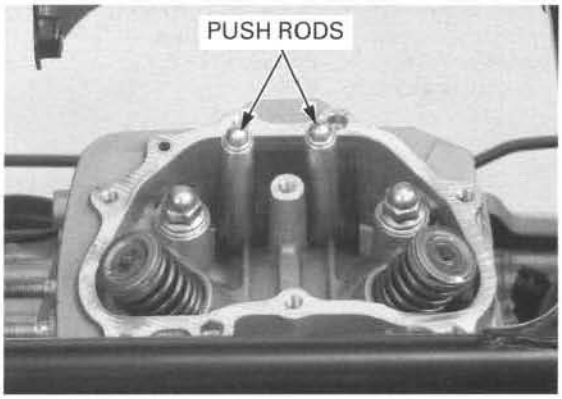
Remove the bolts and carburetor insulator.



Remove the upper engine hanger bracket bolts (engine side).
Remove the upper engine hanger bracket bolt (frame side), mounting rubbers and the upper engine hanger bracket.



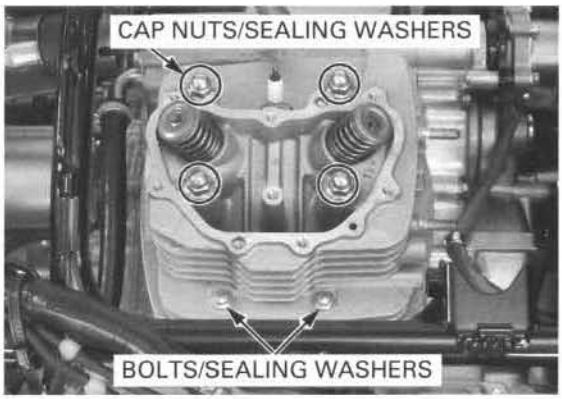
Remove the push rods.



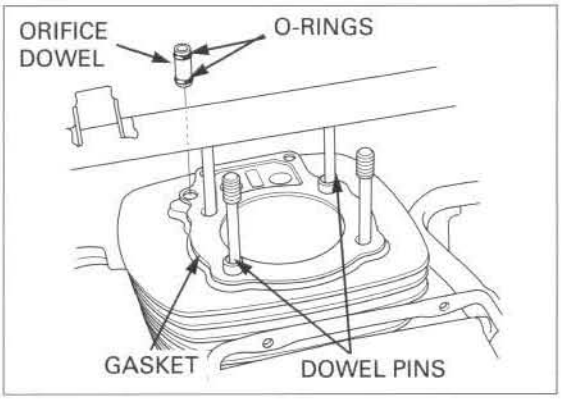
Remove the two cylinder head mounting bolts and sealing washers.
Remove the four cylinder head mounting cap nuts and sealing washers.

Do not strike the cylinder head too hard and do not damage the mating surface with a screwdriver.

Remove the cylinder head.



Remove the dowel pins and gasket.
Remove the orifice dowel and O-rings.

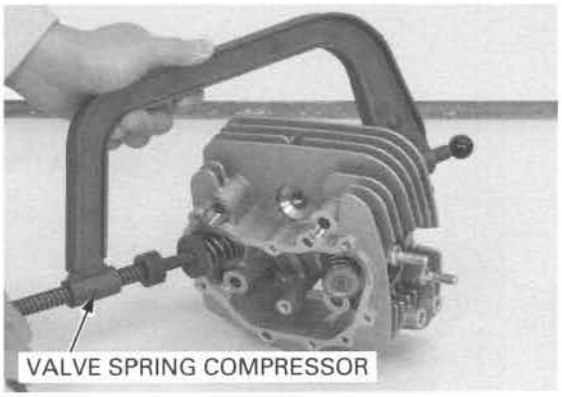


CYLINDER HEAD DISASSEMBLY

To prevent loss of tension, do not compress the valve springs more than necessary.

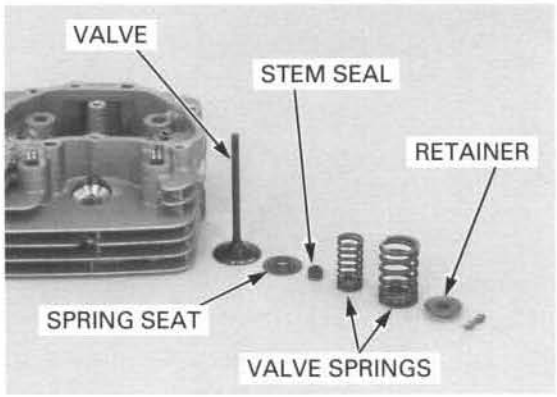
Remove the valve spring cotters using the valve spring compressor.

TOOL:
Valve spring compressor 07757-0010000



Mark all the parts so they can be placed back in their original locations.

Remove the following:
- spring retainer
- inner and outer valve springs
- valve
- stem seal
- spring seat



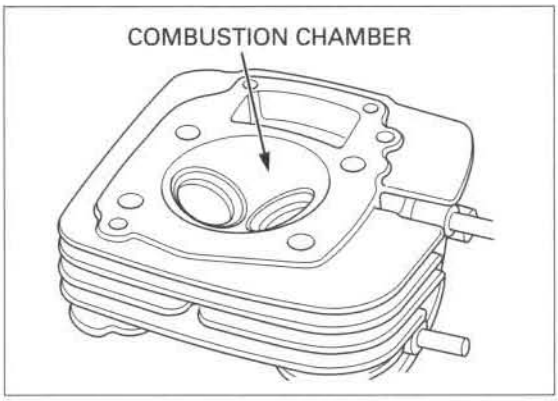
INSPECTION

CYLINDER HEAD

Be careful not to damage the gasket surface.

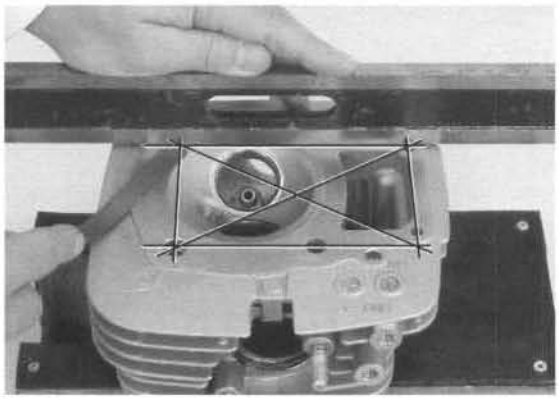
Remove the carbon deposits from the combustion chamber, being careful not to damage the gasket surface.

Check the spark plug hole and valve areas for cracks.



Check the cylinder head for warpage with a straight edge and feeler gauge.

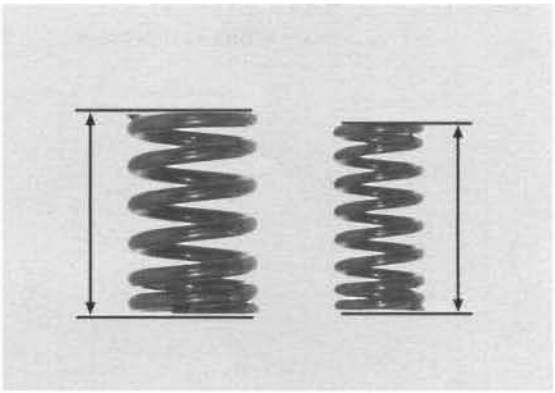
SERVICE LIMIT: 0.10 mm (0.004 in)



VALVE SPRING

Measure the valve spring free length.

SERVICE LIMITS: Inner: 37.04 mm (1.458 in)
Outer: 41.85 mm (1.648 in)



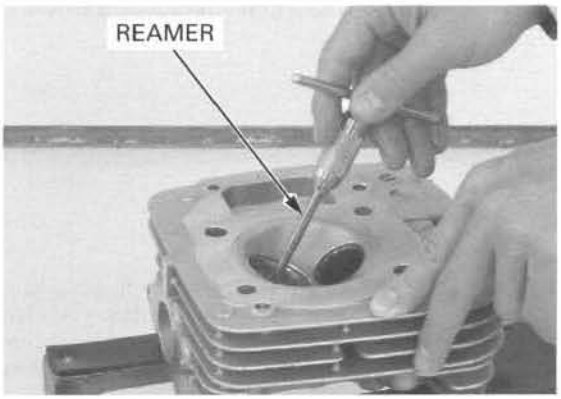
VALVE/VALVE GUIDE

Check that the valve moves smoothly in the guide.
Check the valve for bending, burning or abnormal wear.
Measure each valve stem O.D. and record it.

SERVICE LIMITS: IN: 5.45 mm (0.215 in)
EX: 5.43 mm (0.214 in)

Ream the valve guide to remove any carbon build-up before measuring the guide.
Insert the reamer from the combustion chamber side of the cylinder head and always rotate the reamer clockwise.

TOOLS:
Valve guide reamer, 5.510 mm 07984-2000001 or 07984-200000D (U.S.A. only)

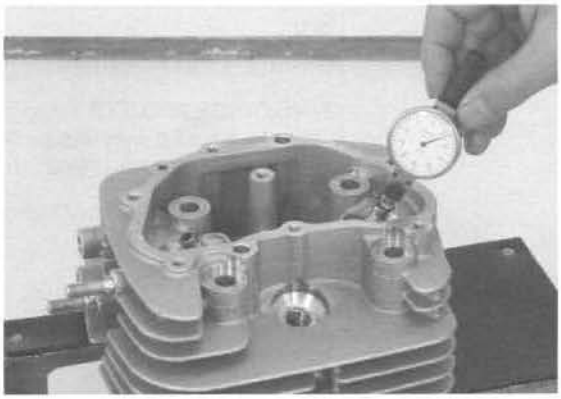


Measure each valve guide I.D. and record it.

SERVICE LIMIT: 5.53 mm (0.218 in)

Subtract each valve stem O.D. from the corresponding guide I.D. to obtain the stem-to-guide clearance.

SERVICE LIMITS: IN: 0.12 mm (0.005 in)
EX: 0.14 mm (0.006 in)



Inspect and reface the valve seats whenever the valve guides are replaced (page 8-13).

If the stem-to-guide clearance exceeds the service limit, determine if a new guide with standard dimensions would bring the clearance within tolerance.
If so, replace any guides as necessary and ream to fit.
If the stem-to-guide clearance exceeds the service limit with a new guide, also replace the valve.